AGRICULTURAL Research

JUNE 1955

MEASURE

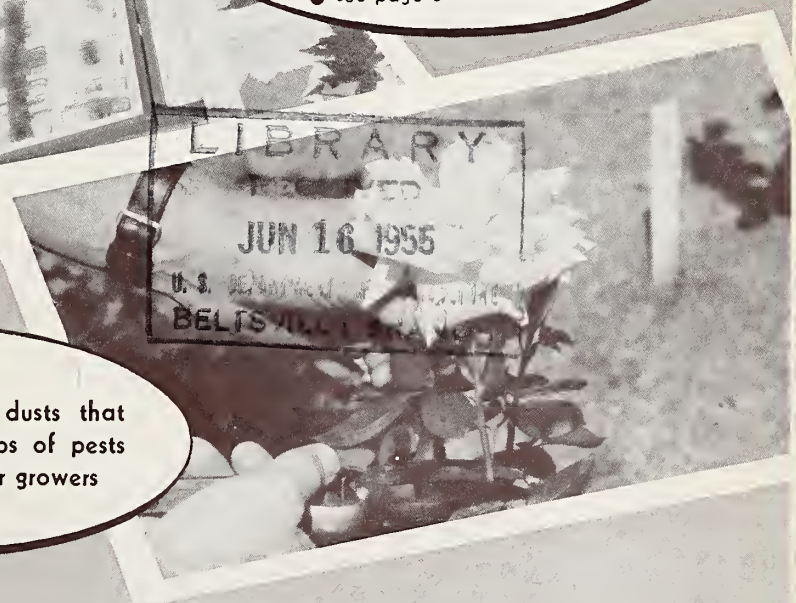
Researchers now measure and study the climate down where our plants are—it's different

● see page 5

TREASURE

A hundred thousand different fungi make this collection a treasure of U. S. agriculture

● see page 8



PLEASURE

Multipurpose rose dusts that combat three groups of pests are new pleasure for growers

● see page 12

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL
Research

Vol. 3—June 1955—No. 12
Joseph F. Silbaugh—Managing Editor
John R. Deatherage—Assistant Editor

CONTENTS

Even greater

Agricultural abundance is commonplace in this country. Nowhere else do so many people live so well.

Behind this abundance are two main forces—mechanization and improved farm practices developed through research.

But what next? Is our technical revolution spent?

By no means. And now is no time to slacken our efforts. Although agriculture has more than met its *first* responsibility—to provide food and fiber for all our people—it also has a *second* responsibility. That is to continue to provide this food and fiber at a decreasing cost of production. This must be done with minimum strain on our land, manpower, and capital, with continuing improvement in rural living.

Here's where the real test comes—it's how efficiently we use our productive resources that determines whether or not we continue to raise our standards of living.

Up to now our greatest progress has been in agricultural *output*. This must be continued to meet the demands of our increasing population. But the future must also bring much more progress in agricultural *efficiency*. This calls for still greater efficiency of farm labor and farming operations.

We have many clues on how to go about the job.

Here's just one: We know from experience that great benefits come through the teamwork of scientists, industry, and farmers in working out combinations of practices for greater efficiency and greater production. Take the recent innovations in dairy practices, for example. Loose housing for dairy cows has been known and practiced to some extent for many years. But the loose-housing system is only now coming into its own as labor-saving equipment such as tractor-operated cleaning gear, automatic watering systems, self-feeding devices, and pipeline milking equipment becomes available. Bulk handling of milk also fits into this pattern.

Every month, stories on these pages tell of changes coming about through the technical revolution in agriculture. This is evidence that the revolution is a continuing force.

And there are encouraging signs that we can expect even greater research advances during the years ahead.

Agricultural Research is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington 25, D. C. The printing of this periodical was approved by the Director of the Bureau of the Budget on August 19, 1952. Yearly subscription rate is $1 in the United States and countries of the Postal Union, $1.35 in other countries. Single copies are 15 cents each. Subscription orders should be sent to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Susceptible (center)
Resistant (outside)

TROUBLE FOR CORN BORERS

Researchers hope to develop corn plants that can stand up to this costly insect

AT Ankeny, Iowa, in the heart of the Corn Belt, USDA and State experiment station scientists are developing strains of corn better able to resist one of this crop's worst enemies, European corn borer.

Target date for release to growers of some of these new strains is 1960. The ARS entomologist-agronomist team of F. F. Dicke and L. H. Penny, of the European Corn Borer Research Laboratory at Ankeny, believe this target date can be met.

Although inbred lines of corn with borer resistance have been developed and used in breeding resistant hybrids, there are no lines now available that withstand both early-season and late-season borer damage.

Corn farmers look forward to the day when they can complement their insecticides and cultural practices with such a powerful weapon as fully borer-resistant plants. This could not only reduce the $100 million in annual losses caused by the borer but also eliminate the effort and expense of mixing and applying insecticides used against this pest.

Federal-State research to develop borer-resistant inbred lines of corn has been under way for many years. During the 1940's, however, a new strain of the European corn borer spread across the Corn Belt—a two-brooded rather than a single-brooded insect. This started Dicke and Penny reevaluating resistance-breeding concepts. They found that:

Resistance, which prevents the corn-borer larvae from feeding, is essential against the first (early summer) brood of this insect.

Tolerance to ear-shank and stalk tunnelling by borers is necessary to save the corn crop from the second (July to September) brood.

First-brood borers, hatching from eggs laid on corn leaves, tend to concentrate near the stalk, in the leaf whorl. Resistance prevents these young larvae from feeding in the whorl, and they starve. But when corn has no resistance, the larvae cut yields by riddling and cutting the leaves and finally by burrrowing into the stalk and destroying the plant's food-carrying system.

The second brood of borers usually occurs after the ears are formed. These larvae feed on ears and ear shanks, then move into the stalk. Unless corn is tolerant to this attack, plants with severe shank injury produce chubby ears, or the ears drop and are missed by the picker.

Borer-resistance, like yield or ear length in corn, is considered genetically as a "quantitative" characteristic—that is, the more resistance factors present in a corn strain, the greater its resistance.

It's fairly easy to establish borer resistance in *new* inbred lines of corn. The scientists began in 1950 with a few promising lines, now have some six hundred. But the next job the researchers face is more difficult—introducing this resistance into hybrids that have other desirable characters such as good yield, disease resistance, and standability.

In a normal backcrossing program, a resistant strain and a susceptible strain are crossed, then plants from this cross are backcrossed with those of the susceptible strain. This can seldom be carried beyond two backcrosses, however, without losing the resistance. The researchers are now attempting to solve this problem by carrying through two backcrosses, then recombining selected plants to intensify the resistance.

Tolerance is gained by choosing—from self-pollinated selections that have been inoculated with stalk-rot organisms—those plants best able to withstand borers and disease.☆

341030°—55

This is larva-eat-larva

PARASITES IMPORTED FROM TRINIDAD SHOW PROMISE FOR PARTIAL CONTROL OF SUGARCANE BORERS

PARASITES of sugarcane borer: Amazon (bottom), slightly larger than housefly, and Cuban (top), a shade smaller. Flies deposit 1 to 3 eggs at entrances of borer holes in cane stalks. Eggs hatch at once. Each fly larva finds a borer larva on which to feed.

CAREFUL with that fly swatter in Louisiana this year! Some of the State's large sugarcane growers have imported $6,000 worth of caesarean-born parasitic flies—at the rate of five for a dollar—to help control infestations of the sugarcane borer on plantations located near Houma.

These flies, Amazon *Metagonistylum minense* and Cuban *Lixophaga diatraeae*, instinctively deposit eggs at the entrance of holes the borers make in sugarcane stalks. The eggs hatch almost immediately. Each fly larva moves in, penetrates a borer larva, and feeds on its living tissue till full grown and ready to pupate. Results: death to the borers, and a new generation of parasites.

Two years of research at the USDA Sugarcane Field Station at Houma convince ARS entomologists Ralph Mathes and L. J. Charpentier that the parasites hold promise as a partial and low-cost means of borer control. Our entomologists don't yet recommend the practice, but the success of their experiments has encouraged some sugarcane growers to give the flies a large-scale tryout.

Aerial dusting with insecticides costs about $9 an acre. It may be that parasites can give considerable borer control for only about $1 an acre. Experience shows that dusting is justified if 7 shoots of cane in 100 feet of row are infested. With 10 infestations, dusting is a must. If parasites can reduce the number of infestations to less than 6 in 100 feet of row, at least 1 or perhaps 2 of the dustings can be eliminated.

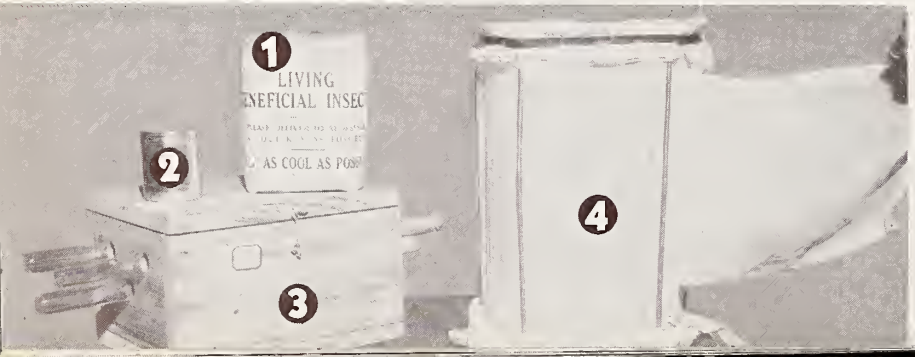
This work by Mathes and Charpentier represents a renewed effort, in cooperation with the Louisiana experiment station, toward biological control of the borer and other sugarcane pests. Attempts made several years ago were largely abandoned because the parasites used couldn't over-winter in sufficient numbers. But today's summer-planted cane, which is not harvested the first year, provides a winter home for the flies.

These insects were being used successfully in West Indian sugarcane, so Mathes got a supply from Trinidad where they are propagated for this purpose. Liberating the flies on four plantations in 1953, the researchers found good establishment the first year and a 75-percent kill of borers on one plantation the following year. Furthermore, the flies established themselves in fields 2 miles away from the release point.

Production of the parasites in quantity begins in a laboratory in Trinidad. Skilled technicians perform caesarean operations on the female flies and take the hatching larvae from them, one by one, with a camel's-hair brush. This is coordinated with the development of laboratory-grown borer larvae to serve as food. Each fly larva, placed on a borer host, begins to feed at once.

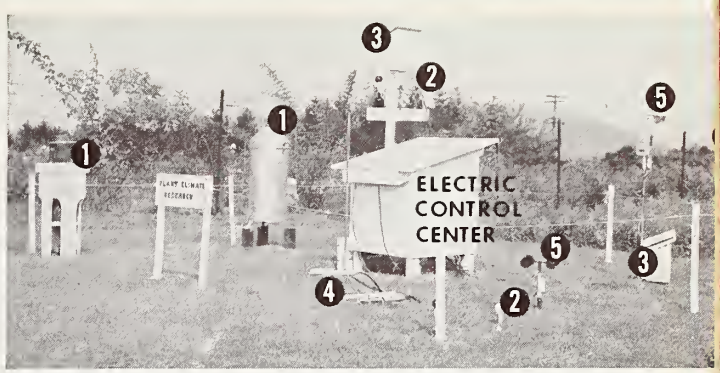
These larvae pupate after 7 to 9 days. Called puparia at this stage, they are ready to be shipped by air mail to buyers (see picture). When the adults emerge and mate, they are released in sugarcane fields, about 5 to an acre. They're now ready to begin their life's work—parasitizing the borers, and regenerating their own kind. which takes place about every 26 days in warm months.☆

LIFE OF PARASITES: Airmail package (1) from Trinidad contains perforated cans (2), each holding four hundred puparia from caesarean-born larvae of parasitic flies. Puparia are held in emergence box (3) at room temperature. As adults emerge, they seek light and gather in the glass vials. Flies are put in mating cage (4)—a wire frame with soft, green organdy cover and some Spanish moss suspended inside. Fed sugar and water, flies are kept in cage 4 or 5 days until eggs begin to develop in females. They're now ready for the sugarcane fields. Entomologist L. J. Charpentier devised this simple equipment to "emerge" and care for flies.



Our crops live in a different climate

Ground-level environment known as microclimate vitally affects plants



METEOROLOGICAL STATION records a pasture's climate grass-high as well as at heights usually checked. Instruments record rainfall (1), moisture evaporation rate (2), air temperature and humidity under shelter as usually read and by thermocouples in tubes grass-high (3 and 4), wind velocity (5), and dewpoint at various levels (6).

MICROCLIMATE — the environment down next to the ground— is playing a key role in study and improvement of forage crops.

USDA agronomist V. G. Sprague and associates at the U. S. Regional Pasture Research Laboratory, State College, Pa., started investigating microclimate 5 or 6 years ago for a better understanding of the behavior of forage crops. Research shows that low-growing plants live in an environment quite different from that generally assumed. Conditions immediately surrounding the plant have a lot to do with vigor of the crop and other agronomic factors.

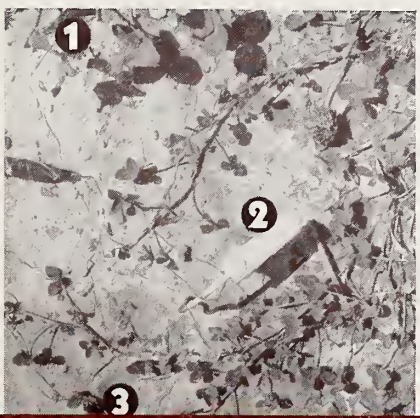
The pasture studies have dealt with microclimate in many situations where winterkill was prevalent or where low plants, such as clovers, were shaded out or weakened within a stand of tall companion plants. Those conditions of temperature, humidity, light, and air movement are then duplicated singly or in combination in a climatically controlled plant cabinet. By growing old, established species or varieties of the crop or new strains of it under those conditions, the scientists are learning more precisely where the fault for stand depletion lies.

Some plants, for example, are susceptible to light deficiency, some to low temperatures, still others to wide variance in daily temperature. *Rate* of temperature change may be more important than mere *range* in degrees. It has much to do with winterkill or survival. The researchers are also learning about climatic factors that foster disease outbreaks.

Alfalfa matted with chickweed was unthrifty at USDA's Plant Industry Station, Beltsville, Md., last winter. Chickweed had restricted air circulation, kept the plant zone damper than elsewhere, and fostered sclerotinia crown rot on the alfalfa. The chief difficulty was not so much that the chickweed had competed with the alfalfa, but that the weed had modified the crop's microclimate. A herbicidal spray killed the weed and checked the sclerotinia crown rot.

This new climatology calls not only for new techniques of weather observation and interpretation, but also for new instruments. One such, the thermocouple—old in physics but new in meteorology—gives simple, easy, accurate running records of the temperature. It records temperature not only in the air but also on the surface of the plant, in its buds and blossoms, in localized disease areas,

ELECTRONIC DEVICES show temperature relationships in a clover stolon (1), in air at plant height (2), and in the soil (3).



MICROCLIMATE is being recorded (humidity in long tube, temperature in short one) for study in relation to vegetation height.

AGRONOMIST Sprague examines clover in a plant chamber having temperature, humidity, and light-intensity under control.

or even within the stem and root. Another instrument, a dewpoint-sensing element, is giving valuable basic information about humidity down at the crop level.

Through these instruments, some basic temperature-moisture relationships in standing alfalfa were revealed. For instance, 100-percent humidity persists longer in the morning and returns 2 to 6 hours earlier in the afternoon at 3 inches elevation than at 24 inches.

Tall plants and dense stands of crops such as forage grasses and legumes reduce high winds to slow air movement at 2 or 3 inches above ground. That and the shade keep humidity high and may foster a disease outbreak on the lower leaves or stems of the crop. In other situations, rapid evaporation may injure the plants directly by drying them out.

Light intensity affects plant vigor. Furthermore, the invisible infrared rays may be as important to plants as the visible rays.

Many crops, as seedlings, are particularly sensitive to weather—especially to temperature, humidity, and wind. By relating microclimate to weather records, it's hoped to work out better planting times.

Microclimate differs from the generally-observed climate in other ways. Night temperatures next to a bluegrass sod may be as much as 6 degrees lower than at shoulder height, where weather observations are usually made. Down in close-growing crops, where plants restrict air movement and high humidity persists late into the morning, daytime temperatures may range to 12 degrees higher.

Since researchers know that air is dampest nearest the ground and at certain hours and on some days, they will take a new look at hay-drying practices. They hope to learn not only the best time of day for mowing, but also the best elevation for air intake in hay-drying equipment.

General climate undeniably has a lot to do with the success of low-growing crops. And even that relationship often is modified by local features of topography or proximity to bodies of water. But the researchers are finding evidence that climatic factors down at the crop level, which differ importantly from those recorded at standard weather installations, often count most.☆

fruits and vegetables

SPECIAL PEACHES MEET SPECIAL PURPOSES

■ NEW SPECIAL-PURPOSE varieties of peach trees now taking root in this country's orchards promise even wider popularity for peaches—plus increased returns for growers.

The trend in peach research is toward more *specialized* varieties, each aimed to suit a particular set of growing and marketing needs, says USDA pomologist A. L. Havis. Nowadays, he points out, a peach bred to do well in one latitude may be far from the best for orchards only a few hundred miles north or south.

This means that growers need to follow variety tests closely to keep up to date on the many new developments in peach breeding. A number of new varieties have been profitably launched commercially, others are just being tried by growers. Here are some that bear watching:

Very early ripeners—Erly-Red-Fre, a white-fleshed semi-freestone, and Dixired, a yellow cling, were new only a few years ago and are now planted widely. A rival variety of theirs is Cardinal, which has performed well in extensive trials in Georgia. Hiland and Redcap need less cold to set buds, find favor farther south. Maygold needs even less chilling and is being tried in south Georgia and north Florida.

Early freestones—Redhaven is outstandingly successful throughout the country except in the Deep South. The earlier Coronet is popular in the warmer Southeast. Prairie Dawn is winter hardy and resistant to bacterial spot. Triogem is replacing the coarser fleshed Golden Jubilee in some eastern and south-central areas. Missouri and Ranger are two other promising yellow peach varieties for the Golden Jubilee season.

July-Elberta and Halehaven season—Sunhigh, high-quality buyers' favorite, is grown from the Central States eastward, despite susceptibility to bacterial spot and spring frosts. Southland and Ozark for southernmost commercial growing areas and Red Globe for the West are other good peaches for this season.

Elberta season—Elberta still leads in spite of weaknesses. Redskin is promising, deserves wider testing. Hale Harrison Brilliant, attractively yellow-skinned, does well when grown and harvested correctly. Loring, Poppy, and M. A. Blake ripen about a week before Elberta, are the most promising for that time.

Post-Elberta season—Late varieties with brighter color and better eating quality are still needed. Rio Oso Gem has proved best in many areas. Breeders are working to improve both trees and fruit of peaches for this wind-up season, when marketing is usually local or short haul.☆

Jobs for Weed Killers

THE EFFECTIVE SPRAY-THEM-DOWN TECHNIQUE IS VERSATILE BUT MUST BE USED WITH CARE

FARMERS' newest weed-killing technique—spraying them down—has practical off-farm possibilities, too. But chemicals must be sprayed with know-how to avoid damage to flowers or other wanted plants.

Home owners, nurserymen, park commission staffs, and others who want to try weed spraying are given this encouragement and warning by USDA agronomist R. J. Aldrich, coordinator of weed investigations in 12 States of the Northeastern Region.

Chief advantage of weed spraying is that it saves tedious labor. It may save money as well where extensive weeding must be done.

For home owners, weed spraying is likely to be useful mainly for lawns. In small home gardens with mixed plantings, there's risk that a weed spray may drift and damage some susceptible treasured plant.

An important precaution for most situations, Aldrich emphasizes, is to keep the spray from drifting, especially when using 2,4–D and 2,4,5–T materials. A shielded boom (or sprayer wand) is standard gear for weed spraying close to flowers and shrubs. Holding the pressure down is advised—high pressure isn't needed to kill weeds and there's less drift with low-pressure sprays.

Watching the weather is important, too. Spray drifts worse on windy days. And a chemical that's otherwise safe may damage wanted plants on hot days—90° or higher.

Aldrich has these suggestions to offer for special situations:

In lawns: To fight broadleaved weeds such as dandelion and plantain, 2,4–D is effective if applied in spring or fall but normally works best in the fall. The same chemical can control wild onion and garlic when applied in early spring before these weeds grow above 4 to 6 inches. Crabgrass in home lawns is best fought by lawn grass itself—which means cutting no shorter than 2½ inches. If grass must be kept short, crabgrass can be killed with chemicals, two of the most popular being phenyl mercuric acetate and potassium cyanate.

Around ornamentals: In hothouses or park flower beds, much hand weeding can be saved by applying a chemical to the soil before weeds emerge. One good material is sodium 2,4-dichlorophenoxyethyl sulfate (SES). It doesn't kill up-and-growing weeds or damage well-started ornamentals, either, as a rule. The effect of SES on many ornamentals is untested, however, so trying this material first on a small area is advised.

There are varied chemicals to choose from for weeds that sprout under high-branching shrubs. Three that give good results are sodium isopropylxanthate (NIX), pentachlorophenol (PCP), and sodium arsenite. Their strength can be adjusted so they kill weeds without leaving a residue likely to damage the roots of wanted plants. Contact spraying works best here, with the chemical directed on weeds through a nozzle shielded with a metal funnel or other spray-restricting device.

Kill all vegetation: On parking lots, vacant lots, and walks, several chemicals applied to soil will make it sterile as long as the toxic concentration remains. Arsenicals, boron compounds, combinations of sodium borate and sodium chlorate, and 3-*p*-chlorophenyl-1, 1-dimethyl urea (CMU) are often used. Small amounts of CMU are very effective and it remains in the soil quite awhile. All these soil sterilants should be used with care, lest they wash or drain where they're not wanted. They can kill roots of even large trees.

Along highways, fences: Brush and broadleaved weeds can be controlled with blended 2,4-D and 2,4,5-T. Tall, woody brush may require cutting plus several spray treatments. Woody brush and thick stumps that may sprout again are best sprayed with these chemicals mixed in oil. The spray should coat the trunk surface up to at least 12 inches.

Poison ivy succumbs to combined 2,4-D and 2,4,5-T, though several treatments may be required. Ammonium sulphamate (AMMATE) is also a good poison-ivy killer. Less volatile than the other two materials, AMMATE is less likely to cause drift damage to ornamentals. On the other hand, it will kill any plant that is well covered.☆

WHAT'S THAT Fungus?

Agricultural treasure of half a million specimens helps identify and study the destructive growths

LOCATING material at NFC is guided through card indexes that show location of specimens in herbarium and information sources on known fungi, including index of each new genus and species. Mycologist B. Lipscomb helps to maintain catalogs of fungi, hosts, and mycological literature.

FUNGUS growths are so destructive to farm crops that only insects cause greater loss, say USDA plant-disease scientists.

Fungi are to blame when fields are stricken by such diseases as smut, rust, blight, wilt, and rot. But often the question is: Which fungus? For on the identity of the fungus hinges a choice of the best fungicides or other controls with which to fight back.

Economic importance of recognizing these parasitic bandits was seen by C. C. Parry, the first botanist ever appointed by the Commissioner of Agriculture (1869). Within a year, he had taken over the Smithsonian Institution's herbarium specimens and was building a collection of plants that included fungi that feed and thrive at farmers' expense.

Today, the world-renowned National Fungus Collections are maintained at the ARS Plant Industry Station, Beltsville, Md., in cooperation with the Smithsonian Institution. In charge of building up these collections for maximum usefulness by scientists is mycologist J. A. Stevenson.

It takes 10 rooms to house the collections, which fill 200 big herbarium cases. Over half a million specimens are now available for study. Specimens are always waiting to be identified for addition to the collections. Last year, the backlog mounted when 15,000 specimens of fungi that damaged forest growth were transferred from the Division of Forest Pathology, New Haven, Conn.

The collections include fungi with no known economic importance so that these may be distinguished from the harmful ones. They also include friendly fungi, such as edible mushrooms, and molds that have produced wonder drugs like penicillin and aureomycin.

But it's mainly the destructive parasitic plant fungi that make the NFC one of this country's agricultural treasures.

To NFC headquarters come researchers from home and abroad. Mail brings letters asking help, along with such evidence as a dried sample of a damaged plant containing spores of the responsible fungus, or the fruiting body. These samples may be as tiny as mold or as conspicuous as big galls. Outgoing mail carries loan specimens. Occasionally, an excited telephone voice asks what to do for Junior who just ate a mushroom he found.

Spores of fungi travel easily and by the billions—carried by air, soil, and water, as well as by moving things and creatures. Some roving spores inevitably find host plants that suit them well in a new country. In Nicaragua lately, snap beans are being attacked by a fungus. A scientist of the Foreign Operations Administration dispatched damaged leaves to NFC for identification. He was quickly told that the fungus was one heretofore known only in Ecuador—spreading, the disease may prove serious, the letter warned.

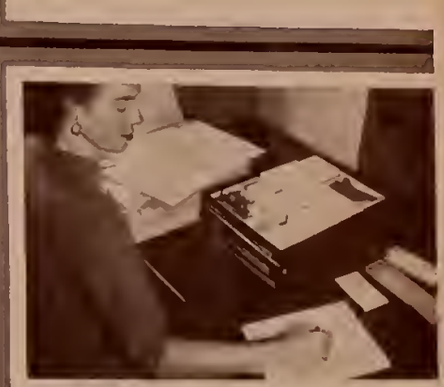
Specimens that become a permanent part of the collections are first arranged by genus. Specimens within these genera—there are 1,599—are alphabetically arranged. There are also special collections kept as units. One of these, the general Smithsonian Collection, fills five cases. Included also are large and valuable special collections—with many rare foreign species—made by self-trained enthusiasts like J. B. Ellis and C. G. Lloyd.

Fungi that cannot be matched among 100,000 recorded kinds continue to be found. Classifying and naming newcomers falls commonly to the NFC staff. It's a responsible task, and exacting. The description and name of a new fungus must be put into Latin, for use the world over. Rules are involved and legal-sounding, given in an International Code of Botanical Nomenclature published by the International Botanical Congress. The code is strictly followed, even by scientists in Iron Curtain countries.

PRESERVING specimens by drying is best for study although fungi thrive in dampness. J. A. Stevenson points out damaged wood—specimen type stored in boxes that fit in metal pigeon holes. Other types are mounted on heavy paper, grouped, and stored (note damaged leaves). Tiny molds are kept on slides for microscope study. Oversized fungi like the wood-rotting polypore at right can only be laid on shelves.

REFERRING to an old illustrated volume, W. W. Diehl, on NFC staff and president of Mycological Society of America, takes notes to identify specimen from a colleague. Background material—books, journals, and reprints—on the world's knowledge of fungi fill this room. (Reprints alone run 35,000.)

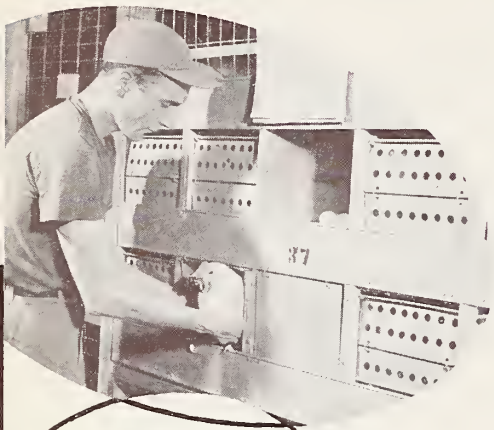
IDENTIFYING fungus by examining fruiting body under microscope is part of detective job by mycologist Paul Lentz. Size, shape, and color of spores, and other clues, thus plainly shown, often settle identity. First binocular under lower powers separates material for study with compound microscope.



LOANING specimens is another service offered by NFC. Mrs. D. Ridgely, aid, carefully packs and records each specimen. In 1954, over 6,000 were sent to botanists at State experiment stations and universities, scientists in many foreign countries, as well as to those over the United States.

STORING each acquisition among half a million specimens is responsibility of Mrs. J. B. Dishman, herbarium aid. Each specimen is pruned, mounted, and labeled. Visiting collaborators sometimes help with this process—often helping themselves also by working closely with a fungus harmful back home.

PROTECTING stored collections are big double-steel herbarium cases that are asbestos-lined for fire protection. The insides of cases are sprayed twice yearly with a specially devised gas as an extra protection against insects. Their heavy doors are fitted with gaskets to foil insects and dust.



BREEDING FOR BETTER POULTRY

Various techniques studied at North Central station

EGGS pour into a testing station at Lafayette, Ind., by the dozen. By the dozen States, that is, because this is headquarters for the work of 12 States cooperating in the North Central States Regional Poultry Breeding Project.

Over-all objective of this project is the improvement of quality and productiveness through breeding. The main job at present is studying the effectivenes of various poultry-breeding techniques. These include conventional family and individual selection, inbreeding, hybridization, and recurrent selection. One practical objective has been evaluation of the relative performance of available hybrids, crossbreds, and purebreds. Another has been combining inbred lines at cooperating stations for possible production of commercially valuable hybrids.

There's good reason for testing at a central location the products of research pursued in 12 separate States. This eliminates differences in environment that make it hard to evaluate data. It's easier to check livability, stamina, and vigor. And testing the birds at a central point promotes quicker exchange of information among researchers.

It is in this connection that USDA's Agricultural Research Service serves as a coordinating agency. Under direction of D. C. Warren, the Lafayette testing station plans its work 3 years in advance. This allows State stations time to plan their operations 2 years in advance.

The testing procedure is this: Approximately 30 eggs from a breeding-technique sample are either produced at Lafayette or sent from a State station for five weekly sets, beginning March 15. Eggs from all samples in a hatch are incubated together and nine female chicks are pedigreed per sample per hatch.

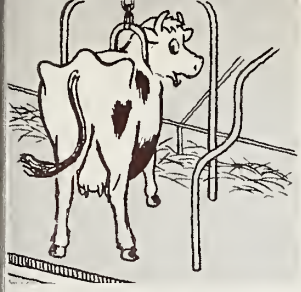
Samples are split into three equal groups and each group is brooded in one large pen. At 8 weeks. birds are moved to the range and remain there until the pullets average 20 weeks. Then they're placed by samples in the test pens and individual egg records are started. Twenty-five pullets (five from each hatch) are taken at random from each sample for the laying birds. The tests consist of 48 consecutive weeks of 3-day-a-week trapnesting (cut from 5 days to 3 in 1954 so one man could handle most of the trapnesting).

Facilities at Lafayette, when completed this year, will give brooding capacity for 15,000 chicks, laying capacity for 5,000 birds, and breeding capacity for 1,000.

Stock under test during 1954–55 include 9 purebreds (5 in duplicate), 6 commercial hybrids (in duplicate and triplicate), 2 reciprocal selections (in duplicate). 8 topcrosses (4 in duplicate), and 52 single crosses (23 in duplicate). Stocks used in the project as a whole—at both Lafayette and cooperating experiment stations—totaled 9,541 breeding birds, 86,119 pedigreed chicks hatched, and 25,751 pullets housed.

Facilities were limited during the first 2 years after cooperating stations sent the first eggs to Lafayette in 1950. Since then, four laying tests have been conducted. Eight inbred tester stocks have been established and will be used for evaluating new inbred lines. About half the 101 inbred lines being carried are ready for evaluation. Recurrent-selection projects are reaching a stage when the first indication of trends can be expected. During the first few years of testing at the Lafayette station, hybrids, crossbreds, and purebreds have each held first place in 1 year.

Cooperating States are Indiana, North Dakota, Michigan, Ohio, Wisconsin, South Dakota, Kansas, Iowa, Illinois, Minnesota, Missouri, and Nebraska. They decided at the outset that Federal money earmarked for research in the States could best be used at first in building the Regional Testing Station. As the location, they chose Purdue University which provided the land. The States asked Warren to supervise the station, in addition to his duties as national coordinator of the Regional Poultry Breeding Projects.☆



The Dairy Behind the Times

dairy

ONLY THE BREEDING VARIES IN BELTSVILLE HERDS THAT HAVE LIVED THE SAME WAY FOR 35 YEARS

VISITORS to USDA's Agricultural Research Center are often surprised to find dairy herds living under conditions like those 35 years ago. No screened stalls, milking parlors, or fans. No special feeds or four-a-day milkings. Just plain living—and high production.

These Jerseys and Holsteins at Beltsville, Md., are perhaps the only United States dairy herds kept under virtually the same conditions for more than a third of a century.

Here's the reason: Back in 1920, experiments were started to give breeders and dairy farmers a living picture of heredity laws at work to produce more milk and butterfat. To do this, research workers have kept all management factors—feeding, housing, milking, and so on—as unchanged as possible through each generation. Use of good sires is the only improved practice. If "blood will tell," it must be the only variable, so far as environment can be stabilized—the introduction of other improved practices would make worthless all the previous data collected in this slow-moving experiment.

True, conditions to begin with were good—better than average for 1920. The Beltsville cattle have always been fed well, never depended on pastures. But new, concentrated nutrition is taboo, even though it might raise production. The herds' consistent, impersonal feeding and handling year after year, though better than on many dairy farms, is not up to the shining-clean production-line care that high producers get in model dairies. Researchers figure it's about typical of management found on a good United States dairy farm.

The breeding program is based on the theory that a bull whose daughters are consistently better milk producers than their dams is relatively pure in his genetic makeup for factors that insure high production. Scientists set out to determine if use of such tested bulls for several generations would gradually build up milk production in the dairy herd.

Results have amply proved this theory, emphasizing the fact that "bulls are better than bulletins" for herd improvement. Fewer low-producing daughters are born with each succeeding proved-sire cross.

All 40 cows chosen at the beginning of the Jersey experiment were pedigreed with high production records, averaging 11,443 pounds of milk and 625 pounds of butterfat a year. Production of succeeding generations went steadily even higher. The third set of 3 sires had daughters whose production averaged 13,996 pounds of milk and 763 pounds of butterfat, even though no cows were ever culled from the herd. Of course, these results would have lost their significance if management practices had changed along the way.

These Beltsville dairy herds comprise a national bank of good germ plasm as valuable as our reservoirs of improved plant stock—but much slower and costlier in the making. Then, too, the Jersey herd proves the danger of closing a herd to outside sires. Jersey milk production gained substantially while proved sires were being brought in but leveled off when the herd was closed against outside sires in 1935. Milk production has never dropped in the Holstein herd, which has been continuously infused with new blood.

The results also underline the value of artificial breeding. Since it was started in this country about a dozen years ago, doubtful dairymen have been able to see in Beltsville herds living proof of the value of good sires. To determine their transmitting ability, young Beltsville bulls have been loaned to artificial-breeding rings, cooperating dairymen, institution herds, and bull associations. About 80 percent of these bulls have sired higher-producing daughters than their dams. The daughters of Beltsville bulls top their dams' production by an average of 800 pounds of milk and 38 pounds of butterfat.

Dairy scientists M. H. Fohrman and J. B. Parker have analyzed foundation cows and the first outbred generation of the Jersey experiments. Some correlation was found between body weight and butterfat production. Inbred daughters produced less milk and butterfat than their outbred dams. Contrary to some breeders' beliefs, scientists found no relationship between age of parents and sex of calves or producing capacity of cows. Nor did cows with many sisters produce more female calves than average, or vice versa.☆

DUSTING OPERATIONS shown here helped produce new multipurpose rose dusts. Barriers enclose individual plots being treated. In the wheelborrow "post office" are dusters containing 29 different formulas.

NEW *Multipurpose* ROSE DUSTS

They deal with the worst of rose insects, fungus diseases, mite parasites

EVERY grower of outdoor roses would like a one-shot dust or spray powerful enough to protect roses against all their flying, crawling, parasitic, and disease-causing foes.

No such "dream dust" is yet in sight, but new multipurpose rose dusts recommended by USDA scientists do much to solve rose-pest problems. Relatively safe and easy to use, these dusts can prevent damage by the most troublesome rose insects, fungus diseases, and mite parasites.

Six of these combination dusts, all roughly equal in effectiveness, have come from work by ARS researchers. The formulas were worked out through systematic trials of different chemicals, applied at various strengths in rose fields and tested for protective power against representative rose pests—aphids and leafhoppers, the organisms that cause blackspot and mildew, and spider mites.

Results of these tests, under way since 1950, came fast last season, after the American Rose Society arranged for nurseries in many parts of the country to ship 2,500 high-quality plants to the Plant Industry Station at Beltsville, Md. Entomologists E. A. Taylor and F. F. Smith and plant pathologist W. D. McClellan supervised the dust experiments.

Exact formulations of the recommended dusts may be hard to buy this summer since they are so new. But by shopping around a grower can probably find mixtures that are similar in composition and effectiveness.

A special feature of all the new mixtures is inclusion of a miticide. The fact that serious rose damage is caused by mites—almost-invisible juice-sucking parasites—was recognized only recently. Last summer, a spider-mite census surprised researchers by the size of mite populations it revealed on roses—sometimes hundreds per leaf. These pests cause leaves to turn brown, stunt growth, and prevent flower formation.

Many miticides are hard to team with fungicides, because chemical interaction between them often results in poor mite-killing power in the blend. Aramite is the only miticide that works well with the fungicides tested. Malathion is highly toxic to mites, but the only fungicide it has been used with effectively in these tests is copper oxysulfate.

Even inert materials used as carriers or diluents in mixtures may weaken a miticide's power. For example, in 1953 neither Aramite nor

DEFOLIATION of Red Radiance rose on left was done by red spider mites. Both black spot and spider were controlled by a new multipurpose dust on rose at right.

Malathion prevented spider-mite damage to roses when applied in dusts containing attapulgite clay as a diluent. Beltsville tests show, however, that talc, prophyllite, calcium carbonate, and sericite all make satisfactory diluents. Sericite was used in the dusts tested last year.

If applied with proper care, the recommended dusts are harmless to rose plants and to gardeners. But all the dusts are poisonous and must not be swallowed or inhaled. They can be applied with plunger-type hand dusters. Dusting once a week during the blossoming season normally gives good control. A pound of dust is enough per application for a rose plot 20 by 60 feet (that's the equivalent of 35 pounds per acre).

The new dusts have limitations, of course. They won't control thrips or adult Japanese beetles. In these tests, no dust saved opening rosebuds when these pests alighted and fed on inner, undusted petals.

The six most effective rose-dust mixtures tested all contained 5 percent DDT and 1 percent lindane as *insecticides*, plus one of the following *fungicide-miticide* combinations (copper, sulfur, ferbam, Karathane, and zineb are fungicides; Aramite and malathion are miticides): (1) 3.4 percent copper, 25 percent sulfur, 1.5 percent Aramite; (2) 3.4 percent copper, 25 percent sulfur, 4 percent malathion; (3) 7.6 percent ferbam, 25 percent sulfur, 1.5 percent Aramite; (4) 7.6 percent ferbam, 1 percent Karathane, 1.5 percent Aramite; (5) 6 percent zineb, 1.5 percent Aramite; (6) 6 percent zineb, 1 percent Karathane, 1.5 percent Aramite.

Taylor, Smith, and McClellan are continuing work to check comparative usefulness of sprays. The scientists also look toward better ways to foil thrips—by applying insecticides directly to the flowers and to barriers around rose plots, and by removing older or faded blossoms.☆

Lambs gain faster on less feed when it's pelleted

■ LAMBS FATTEN ON LESS FEED when it's blended and pelleted rather than fed separately and loose.

USDA experiments at the Agricultural Research Center, Beltsville, Md., showed that lambs reach desired market weight sooner on pelleted feed by eating more per day. They're more efficient for two reasons. While the lambs *use* about the same amount of feed per day, they *eat* more of it—waste less. And the reduced fattening time *saves feed that would go into several extra days' body maintenance and activity.*

I. L. Lindahl, ARS researcher who made the study, thinks the lambs found the ration tastier, on the whole, and ate more. The reason is not clear. The absence of dust, which they dislike, may be a big factor. Less bulkiness may also appeal to them. Lindahl found no significant difference in the digestibility of the two forms of an identical ration.

When pelleted feed was kept before the lambs at all times, they gained one-third to one-half faster, required one-fourth fewer days to reach market weight, and used 20 to 30 percent less total feed than when hand-fed with the same diet in loose form. Keeping loose feed before the lambs also proved more efficient than hand-feeding it.

On a diet of 45 percent yellow corn, 5 percent blackstrap molasses, and 50 percent No. 2 alfalfa hay, lambs gained an average of 0.31 pound per day on loose feed hand-fed, 0.34 pound per day on loose feed self-fed. On the same diet pelleted and self-fed, lambs gained 0.42 pound per day. The three feeding methods required 972, 908, and 772 pounds of feed, respectively, to put on 100 pounds of gain.

On another diet of 50 percent barley, 5 percent blackstrap molasses, and 45 percent No. 2 alfalfa, the respective gains from different feeding methods were 0.29, 0.42, and 0.43 pound per day, and feed consumption was 1,210, 847, and 832 pounds per 100 pounds of gain.

Scientists got similar evidence in lamb-feeding tests at the Illinois and New Mexico experiment stations.

While these tests demonstrated that lambs can be fattened quicker and on less feed when pelleted, further study is needed to find out whether the extra benefit is worth the cost of pelleting.☆

INFERTILITY

Look for VIBRIOSIS

This venereal disease—difficult to detect and diagnose—is a major cause

EVER hear of vibriosis? It's a disease that costs United States dairymen and beef ranchers an estimated $172 million a year.

Like embezzlement in a bank, this venereal infection is serious but may exist undetected for a long time. Although it probably accounts for 40 percent of the infertility in our beef and dairy herds, many cattlemen don't even suspect that the disease causes breeding losses.

That's understandable, because little has been known about vibriosis. Its widespread occurrence and association with low cattle fertility have only recently been recognized. And it has no obvious symptoms.

In a newly infected herd, the only apparent sign of vibriosis is failure to conceive—noted as cows, old or young, return repeatedly to service. In a herd where vibriosis is well established, repeat breeding may be most noticeable among the heifers. Older cows often seem to develop immunity which further complicates diagnosis. For example:

A virgin heifer bred to an uninfected bull drops her first calf with no trouble. Bred next time to an infected bull, she may get vibriosis and not conceive for 3 to 12 months. Then, on her next service, conception may occur again, indicating that she has developed immunity. Not much is known about the degree or duration of this immunity.

USDA animal pathologist A. H. Frank emphasizes that vibriosis is the only specific bacterial disease of the venereal type regularly found in herds with a history of impaired fertility. Veterinarians know it's caused by the organism *Vibrio fetus*. (*Vibrio* bacteria are a common contaminant of water. Various members of the group cause digestive troubles in man, Asiatic cholera, rat-bite fever, inflammation of the intestinal tract in pigs, other ailments.)

ARS researchers have never isolated *Vibrio fetus* from virgin cattle. Most evidence indicates that this organism is spread by breeding, though some signs point to the possibility that vibriosis may be transmitted from bull to bull or cow to cow.

Another *Vibrio* bacterium is now under study to discover what connection it may have with animal infertility. Although this recently identified microorganism does not appear to cause infertility in cattle, it is frequently found wherever *Vibrio fetus* is present, except in aborted fetuses. It has not been observed in virgin heifers but may (unlike *V. fetus*) occur in virgin bulls.

Frank and colleague J. H. Bryner have developed a test to distinguish readily between material containing *Vibrio fetus* and the apparently nonpathogenic *Vibrio*. This test is based on the action of catalase—an enzyme produced by some bacteria—which decomposes hydrogen peroxide into water and gaseous oxygen. *Vibrio fetus* has high catalase activity, the other *Vibrio* little or none.

Vibriosis in cows may be diagnosed by an agglutination test of vaginal mucous, similar to the blood-agglutination test for brucellosis (AGR. RES., February 1955, p. 10). The same method can be used for bulls by mating them to cows known to be free of vibriosis, then testing the cows.

Antibiotics seem to help reduce the impact of vibriosis. Satisfactory rates of conception have been established in infected herds through artificial insemination, using semen with antibiotics added. Streptomycin and penicillin, streptomycin and sulfa, and in a few cases all three drugs, are the combinations now employed. This practice won't end all the breeding troubles in a herd, of course, but it no doubt aids in controlling the spread of this disease.

Frank and other ARS researchers working on the problem of infertility in livestock welcome the increased use of antibiotics against vibriosis. But they believe more positive control methods can eventually be developed as we learn more about the disease. They seek better understanding of both *Vibrio* organisms.

Frank hopes more cattlemen will come to realize how costly vibriosis is so they will look for it as one of the primary causes of infertility. He advises farmers who suspect vibriosis in their stock to get in touch with their State veterinarians and see what diagnostic and control measures can be worked out.

Meanwhile, he and his coworkers are continuing their investigations to gain greater knowledge of this disease and develop improved methods for its diagnosis and control.☆

More WOOL GREASE AND *Less* STREAM POLLUTION

■ WE MAY GET MORE WOOL GREASE (crude lanolin) and less stream pollution from wool-scouring wastes with a new treatment process developed at the USDA Western Regional Research Laboratory, Albany, Calif.

Raw wool must be washed or "scoured" before further processing, and the resulting wastes cause heavy pollution when dumped into streams. Disposal of wastes from scores of plants—mainly in heavily industrialized and populated New England—has long been a serious problem.

A number of the country's wool-scouring plants now use grease-removing systems. Some of them operate on the centrifuge principle and others employ acid as the removal agent. Neither system has proved entirely satisfactory for waste clarification.

At the Albany laboratory, ARS chemist Willie Fong inserted another step in the conventional acid process—addition of the claylike material bentonite to the scouring wastes. (Bentonite, found in various parts of the United States, is a gelatinous mineral of high absorptive power.)

Fong's new method for wool-grease recovery calls for first acidifying the scouring wastes with sulfuric acid (to a pH level of 3 to 4), then adding 1 to 5 pounds of bentonite per 100 gallons of water.

In laboratory tests, this combination treatment removed 95 to 98 percent of the wool grease, compared to 60 to 80 percent with acid alone. Addition of bentonite improves overall clarification of the waste material, promotes coagulation of the grease, and removes some of the water-soluble impurities. It also reduces the amount of acid required.

So far, plant tests of the new method have not permitted convenient recovery of the wool grease removed. Further tests are being made by the Western laboratory to see if this problem can be overcome. No serious difficulties have yet been observed in carrying out the treatment with conventional equipment now employed in the acid process.

This development is a promising contribution to USDA research on better waste-disposal methods. (An answer to the dairy-waste problem was reported in AGRICULTURAL RESEARCH, March 1955, p. 4.)

Annual recovery of wool grease—which sells for 6 to 36 cents a pound, depending on purity—now averages an estimated 10 million pounds. This is only 10 to 15 percent of the potential. Wool grease is used in making such items as cosmetics, leather, lubricants, rust preventives, adhesives, printing inks, paints, cordages, and furs. Our supply of wool grease, particularly the cheaper grade, has been short the last 2 or 3 years.☆

Readers' REACTIONS

Prints

SIR: I'd like to borrow prints of the ring-test art used in the April issue of AGRICULTURAL RESEARCH ("The Ring Test Spots Brucellosis," p. 8).

With the wide use and interest in the test, I find myself surprised that apparently you alone saw the picture story in it.—ELLIS RAWNSLEY, Farm Editor, Cincinnati Times-Star.

● Thanks. Incidentally, the first sentence of legend "3" under "Taking the Sample" should have read: "A dipperful (about a teaspoon) from no more than three cans of milk from same herd is pooled in test tube." The "three" was inadvertently omitted in revising a proof.—ED.

Copies

SIR: We are interested in writing an article on farm walk-in freezers for our monthly Agricultural Bulletin. Would it be possible for you to send us a copy of AGRICULTURAL RESEARCH for May–June 1953 ("Big Freeze Walk-in Refrigerator," p. 14)?—VIRGINIA L. CARTER Information Office, Department of Agriculture and Immigration, Commonwealth of Virginia, Richmond.

● We have a small stock of back copies that can be supplied for reference and completing files. Some issues, however, are near the bottom.—ED.

Cuts

Frequently, we receive requests for cuts used in AGRICULTURAL RESEARCH.

We regret that we can't fill these requests—all cuts that appear in the magazine are the property of the Government Printing Office.

GPO, however, will furnish electroplate copies of cuts at a nominal charge. Requests should be addressed to Public Printer, Government Printing Office, Washington 25, D. C.

Ordinarily, we can supply prints of pictures and other illustrations used in AGRICULTURAL RESEARCH for those who wish to make their own cuts.—ED.

UNITED STATES GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS, WASHINGTON 25, D. C.

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
GPO

OFFICIAL BUSINESS

agrisearch notes

FOUR CUCUMBER varieties are outstanding for brining use.

Tests by the USDA utilization research group at Raleigh, N. C., in cooperation with the North Carolina experiment station, showed Model, Packer, Earliest of All, and Ohio MR–17 best among 19 varieties and strains of cucumbers tested.

These 19 ranged from good to poor in firmness, proportion of bloaters (hollow pickles), shape, size range, and color—all important in pickling. A panel of pickle producers ran the tests on color, size, and shape, important commercial acceptance factors.

Productivity and adaptability for uses other than brining also are important considerations in choosing a cucumber variety for pickling.

IT STILL PAYS to grow potato varieties that resist the common form of late blight, even if they can't hold out indefinitely against unusual races that have appeared in major growing areas.

ARS vegetable-crops specialists F. J. Stevenson and R. V. Akeley draw this conclusion from 2 years' tests in Maine with such varieties as Cherokee, Delus, Kennebec, Merrimac, Pungo, Seco, and Sebago, developed by USDA in cooperation with State experiment stations. All these varieties, except Sebago, are highly resistant, if not immune, to the most common late-blight fungus. Sebago is moderately resistant.

In the Maine experimental plantings, the highly resistant varieties warded off even specialized races of the fungus until a satisfactory crop of potatoes was grown. Susceptible varieties, however, were badly injured by the disease several weeks before the crop matured.

At least 10 specialized races of late blight were found in the field in 1954, a bad blight year in Maine. Two susceptible potato varieties produced only half a crop, even when aided by fungicidal copper spray. Yet in this bad year, blight-resistant potatoes given no fungicial help made almost a full crop and had moderately good dry-matter content—indicating satisfactory market quality. When these blight-resistant varieties were sprayed with copper in a bad season, however, they gave enough additional yield and dry-matter content to make the spraying pay. This shows that genes for resistance and control measures can be copartners in potato production. The specialists are therefore advising that growers spray even blight-resistant plants in serious blight years.

RIO AND PALMETTO, two varieties of sesame (an oilseed crop), have been announced by USDA and the Texas and South Carolina experiment stations.

These are the first *non-shattering* sesames—varieties adapted for mechanical harvesting—so far released for commercial production. They yield well. Limited foundation seed has been distributed to qualified growers of certified seed who cooperated in development of sesame as a crop. Certified seed should be available this fall to plant considerable acreage. (USDA has no seed for distribution.)

Seeds of these varieties have an oil content of about 49 percent. Sesame oil has a pleasant, bland flavor and is highly valued for food use. It's easy to process and refine, has unusual flavor stability. The remaining meal runs about 55 percent crude protein and should be useful as a feed supplement for livestock.

U. S. GOVERNMENT PRINTING OFFICE: 1955